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Reasons for Exterior Effective Brick Walls Deterioration as Exemplified with Buildings under Construction

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Abstract

This article discusses the problem related to the appearance of defects in masonry cladding layer of self-supporting walls of buildings with monolithic concrete frame as exemplified with the inspection of buildings under construction in the residential quarters of "October" district of Novocherkassk. As a result of the survey by OOO "SPU" specific defects in the self-supporting layer of facing walls of buildings were identified and described and their causes were identified. Based on the existing expertise, instrumental testing of the construction materials, conducted by a certified testing laboratory, the survey materials present an overview of the causes for the identified defects as studied by other professionals and organizations, one of the leading of which is CNIISK. VA Kucherenko. Based on the results of the systematic analysis of the detected defects and instrumental research data the authors proposed several solutions aimed at eliminating the defects and bringing the building up to the standard.

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Keywords: defects in masonry; brick instrumental studies; test brick; self-supporting wall.

1. Introduction

During the construction of modern high-rise buildings with monolithic concrete frame as walling, in most cases, apply self-supporting brick walls, made effective masonry. Outdoor mile of brick self-supporting walls are often made of decorative bricks [1-14], creating a certain color scheme and personality building facade.

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However, despite the popularity of the existing technologies for construction of buildings with self-supporting walls, problems arise in the production of stone works, which require a special approach to their solution. Deep enough these issues were studied by specialists CNIISK. VA Kucherenko [7, 11].

2. Solution Description

During the construction of modern buildings with reinforced concrete frame and self-supporting brick walls, made effective by laying sufficiently often defects associated with impaired technology devices expansion joints. This article discusses the results of a survey of multi-storey residential block of buildings in the neighborhood "October" in the city of Novocherkassk, Rostov region (Fig. 1), where the facade of the building revealed characteristic defects facing layer of masonry, which were recorded in the survey of similar buildings in other cities in the region.

Fig. 1. General view of the buildings

An examination of the external surfaces of the facades of buildings by OOO "Construction and Production Management" following characteristic defects in the outer layer of the decorative masonry wall were identified:

- detachment of the decorative layer of brickwork in the level of floor slab (1st to 6th floors) (Fig. 2).
- vertical and inclined cracks in various areas of external masonry walls of buildings opening width of 0.5 mm to 3 mm (Fig. 3).

According to the project documentation for the construction scheme of the building with a monolithic concrete frame and self-supporting brick walls.

In accordance with the recommendations of [15-17] masonry exterior walls is designed efficiently from the outer decorative layer of 120 mm thick bricks, insulation layer and an inner layer of light concrete blocks. Wall resistance is provided by the inner layer. The outer and inner layers are attached together by flexible connections reinforcement and a facing bearing layer carried on a steel corner welded to the ends of the mortgage details overlap.

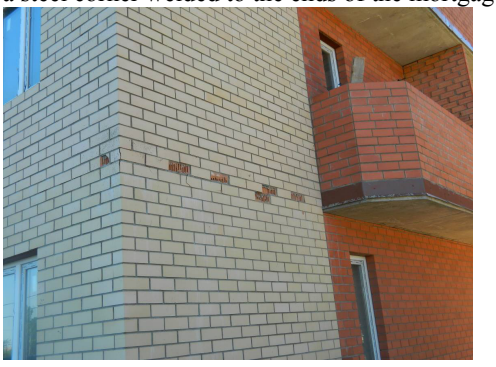

Fig. 2. Destruction of material masonry facade wall in the overlap level

The reason for the destruction of the surface layer of bricks in the level of overlap is no horizontal joints, provided the requirements of [18], intended to compensate for the difference between the vertical deformation of the outer and inner layers of the outer walls, floors sag, as well as the building frame. According to para. 9.83 [18] horizontal expansion joints in exterior curtain walls must be carried out at the lower edge of interfloor slabs the entire thickness of the wall at least 30 mm thick.

However, guidance on the device of horizontal seams project were not provided. Due to the fact that the horizontal joints in the brickwork buildings surveyed no load on masonry floors summarized as its location relative to the above positioned.

Fig. 3. The vertical crack opening width up to 3 mm wall facade. The destruction of brick material

The results of the testing calculations found that the brickwork of the lower floors of buildings housing complex is located in a congested state, which led to the destruction of materials masonry walls in local areas first six floors.

It is also one of the causes of destruction of brick face layer is a discrepancy between the strength characteristics bricks of "KERAMIN" stated performance characteristics. According to the results of laboratory tests of samples of ceramic bricks facial hollow thickened KULPu-1,4NF/150/1.2/50 GOST 530/2007, as determined by the [19, 20] in the Institute of Construction Technology Laboratory "Building technologies" YURGPU (NPI) name MI Platova its mark on the compressive strength corresponds stamp M100 GOST 530-2012, which corresponds to the design solutions, however, during the test brick compressive strength under a load of 2.0 MPa was observed destruction engobe layer and its peeling, while maintaining the integrity of the main body of bricks . This indicates a sharp contrast to the strength properties of the crock and its actual brick facing layer (engobe) due to differences of technological properties of the used mass (sintering) (Fig. 4).

Fig. 4. Laboratory tests of strength of bricks.The destruction of the facing layer by application of a load of 2.0 MPa

With regard to education and disclosure of vertical and inclined cracks in the facial layer of masonry, then there is a lack of vertical joints to compensate for temperature and humidity strains, exacerbated by the lack of horizontal joints. According to [18] in the facial layer of lightweight masonry exterior walls based on temperature and humidity impact the vertical expansion joints must be provided. Device vertical joints was also not provided by design.

3. Conclusion

According executed by OOO "SPU" research and testing it was found that the main causes of the detected defects is not only the fault of designers, but also the use of low-quality facing material in the finishing of the exterior walls.

References

[1] Y.N. Murzenko, Methods of experimental research collaboration of foundations and compressible foundation static load, in: Proceeding of Experimental study of engineering structures: Materials to II Symposium. (1969) 12–21.
[2] J.N. Murzenko, Basic principles of modeling collaboration of foundations and sandy base, in: Proceeding of Experimental study of engineering structures: Materials to II Symposium. (1969) 85–93.
[3] N. Murzenko, Testing Machine MF-1 for experimental investigations of the foundations, Math. Universities. Construction and architecture. 10 (1965) 21–26.
[4] J.N. Murzenko, Experimental and theoretical studies of the impact of the power bases and sandy grounds, Dr. diss., Novocherkassk, 1972.
[5] E.V. Arinina, Experimental study of stress-strain state of the sandy grounds under axisymmetric loading, Ph.D. diss., Novocherkassk, 1972.
[6] K.K. Kulikov, Experimental research collaboration dense sandy grounds and assorted strip foundations, Ph.D. diss., Novocherkassk, 1969.
[7] Y.A. Tarikuliev, Experimental research of contact pressure under the sole foundation on the sandy square basis, Ph.D. diss., Novocherkassk, 1968.
[8] J.N. Murzenko, Y. Malyshev, V.P. Rack, Experimental studies of the strain tensor and the stress tensor on the axis of the round stamp on the sandy basis, Investigation of stress-strain state of the grounds and fundamenov, NPI, Novocherkassk, 1977.
[9] V.V. Rivenko, Experimental study of stress-strain state of the sandy grounds under the round stamp, Ph.D. diss., Novocherkassk, 1982.
[10] V.V. Shmadov, Deformation of foundations solid slab foundation in the nonlinear stage of the work, Ph.D. diss., Novocherkassk, 1985.
[11] A.I. Subbotin, Work foundations limited distribution ability, Ph.D. diss., Novocherkassk, 1995.
[12] G.M. Skibin. Investigation of the interaction of soil foundation and continuous footing and optimization of design solutions, Ph.D. diss., Novocherkassk, 1998.
[13] M.G. Skibin, S.P. Gusarenko, A.M. Zotov, Features of the stress changes in the construction of buildings at the device they controlled foundations, in: Proceeding of Intercollege. thematic. Scientific-practical and theoretical problem geotechnics, SPb., 2009.
[14] M.G. Skibin, A.R. Aydinian, A.I. Subbotin, RU Certificate of state. registration of the computer program 2011610432. (2011).
[15] M.G. Skibin, Interaction adjustable foundations of buildings with ground base when lifting and leveling jacks, Ph.D. diss., Novocherkassk, 2012.
[16] I. Chizh, G.M. Skibin, Development of the method of calculation of optimum depth of the separation sheet piling in the cramped conditions of construction, Herald PNIPU: Construction and architecture. 3 (2014) 60–72.
[17] N. Murzenko, Load cells with a circular diaphragm for measuring stress in the ground, in: Proceeding of Experimental study of engineering structures: materials to the II Symposium, Leningrad. (1969) 59–67.
[18] Y.N. Murzenko, V.V. Shmatko, G.M. Skibin, V.N. Morgunov, A.I. Subbotin, USSR A.S. 1768703. (1992).
[19] G.E. Lazebnyk, Experimental study of stresses in structures, Light geotechnics. 1 (2004) 27–31.
[20] G.E. Lazebnyk, Earth pressure on structures, NPPNV, Kyiv, 2005.
[21] A.I. Subbotin, M.G. Skibin, Automation of experimental research work of the foundations, Collected Works, Series: Sector engineering, construction, Poltava. nat. Sc. University of Nat. Y. Kondratyuk. 38 (2013) 335–342.